

IN THE CLAIMS:

Please amend claim 150 as follows:

150. (Currently Amended) A liquid crystal display device, comprising:

a first substrate and a second substrate for sandwiching a liquid crystal having a negative dielectric constant anisotropy, and orientations of the molecules of said liquid crystal being almost generally vertical to the said first and second substrates when no voltage is applied;

said first substrate including first domain regulating means for regulating azimuths of the orientations of said liquid crystal molecules when a voltage is applied to said liquid crystal, said azimuths of orientation being defined as angles of alignment of said molecules in a plane generally parallel to planes of said first and second substrates; and

said second substrate including second domain regulating means for also regulating azimuths of the oblique orientations of said liquid crystal when a voltage is applied;

said first domain regulating means including protrusions projected into a layer of said liquid crystal, said protrusions being made of dielectric materials seated upon a first electrode of said first substrate, said protrusions having line portions; and

~~molecules of said liquid crystal being substantially mirror-symmetrically aligned with respect to planes each of which includes each line portion of said protrusions and is vertical to said first and second substrates; and~~

said azimuths of orientation respectively aligning according to a shape of a near one of said protrusions seen looking vertically to said planes of said substrates.

151. (Previously Presented) A liquid crystal display device according to claim 150, wherein pixel electrodes are formed on said second substrate, each of said protrusions extends along a generally straight line, and said protrusions are arranged in parallel to one another with a predetermined pitch among them.

152. (Previously Presented) A liquid crystal display device according to claim 151, wherein said predetermined pitch is equal to an arrangement pitch of said pixel electrodes, said protrusions extend in parallel to edges of said pixel electrodes and pass on positions facing toward centers of said pixel electrodes.

153. (Previously Presented) A liquid crystal display device according to claim 150, wherein said first domain regulating means further includes depressions depressed from said layer of said liquid crystal.

154. (Previously Presented) A liquid crystal display device according to claim 153, wherein said protrusions and said depressions are mutually arranged in parallel with a predetermined pitch.

155. (Previously Presented) A liquid crystal display device according to claim 150, wherein a ratio of the area of said domain regulating means to that of each pixel is less than 50%.

156. (Previously Presented) A liquid crystal display device according to claim 150, wherein said second domain regulating means includes a second structure provided on said second substrate.

157. (Previously Presented) A liquid crystal display device according to claim 156, wherein said second structure is made of dielectric materials provided on electrodes of said second substrate.

158. (Previously Presented) A liquid crystal display device according to claim 157, wherein said second structures include protrusions projected into a layer of said liquid crystal.

159. (Previously Presented) A liquid crystal display device according to claim 158, wherein a diameter of spherical spacers, which define a thickness of said

layer of said liquid crystal, is a difference resulting from subtracting a height of said protrusions of said first and second domain regulating means from a desirable thickness of said liquid crystal layer.

160. (Previously Presented) A liquid crystal display device according to claim 159, wherein a ratio of area of said protrusions with respect to display area is between 1/10 to 1/2, said spacers have a particle size distribution whose standard deviation is 0.1 to 0.3 micrometers, and said spacers are dispersed with a density of 300 particles per square millimeter.

161. (Previously Presented) A liquid crystal display device according to claim 159, wherein the hardness and the elastic modulus of the material forming said protrusions are larger than those of said spacers.

162. (Previously Presented) A liquid crystal display device according to claim 158, wherein a sum of the height of said protrusions of said first domain regulating means and the height of said protrusions of said second structure is equal to a desirable thickness of a layer of said liquid crystal, and said protrusions of said first and second domain regulating means are arranged to at least partially overlap each other so that said protrusions define a thickness of said layer of said liquid crystal.

163. (Previously Presented) A liquid crystal display device according to claim 158, wherein said protrusions of said first domain regulating means are protrusions formed with a two-dimensional lattice, and said second structure includes point-like protrusions respectively facing centers of each frame element of said two-dimensional lattice.

164. (Previously Presented) A liquid crystal display device according to claim 163, wherein at least one of arrangement pitches of said two-dimensional lattice is smaller than one of arrangement pitches of pixel electrodes.

165. (Previously Presented) A liquid crystal display device according to claim 163, wherein arrangement pitches of said two-dimensional lattice coincide with arrangement pitches of pixel electrodes.

166. (Previously Presented) A liquid crystal display device according to claim 165, wherein said protrusions having said two-dimensional lattice form are arranged on boundaries of pixel electrodes on a TFT substrate on which active elements are formed, and said point-like protrusions are arranged on a color filter substrate facing said TFT substrate so that each point-like protrusion faces toward a center of each pixel electrode.

167. (Previously Presented) A liquid crystal display device according to claim 158, wherein said protrusions of said first and second domain regulating means extend along rectangular edges of similar figures of different sizes, and said protrusions are mutually arranged so that centers of respective rectangles coincide with each other.

168. (Previously Presented) A liquid crystal display device according to claim 167; wherein said rectangles are similar to said pixels, a maximum size of said rectangle is less than that of each pixel, and said rectangles are mutually arranged so that centers of said rectangles coincide with a center of each pixel.

169. (Previously Presented) A liquid crystal display device according to claim 158, wherein at the edges of each pixel electrode extending in parallel to the extending direction of said protrusions, the protrusions nearest to the pixel electrode inside said pixel electrode are located on said second substrate, and the protrusions nearest to the pixel electrode outside said pixel electrode are located on said first substrate.

170. (Previously Presented) A liquid crystal display device according to claim 169, wherein said protrusions nearest to said pixel electrode outside said pixel electrode are arranged on a bus line.

171. (Previously Presented) A liquid crystal display device according to claim 158, wherein said first and second domain regulating means are arrays of protrusions, and in said array of protrusions, at least one repetition condition of the array such as the width of the protrusions, the interval between adjacent protrusions and the height of the protrusions includes at least two different values.

172. (Previously Presented) A liquid crystal display device according to claim 171, wherein the interval between adjacent protrusions is smaller in the neighborhood of the bus line than at the central portion of the pixel.

173. (Previously Presented) A liquid crystal display device according to claim 171, wherein a plurality of pixels constitute a set of pixels, at least one of the width of the protrusions, the interval between adjacent protrusions and the height of the protrusions is different among a plurality of pixels constituting each set of pixels, and the width of the protrusions, the interval between adjacent protrusions and the height of the protrusions are fixed in each pixel.

174. (Previously Presented) A liquid crystal display device according to claim 173, wherein the thickness of the layer of said liquid crystal is different at the plurality of pixels constituting the set.

175. (Previously Presented) A liquid crystal display device according to claim 158, wherein said first and second domain regulating means are arrays of protrusions, and said array of protrusions includes periodically-repeated protrusions having two or more different values of side surface inclination angles.

176. (Previously Presented) A liquid crystal display device according to claim 175, wherein a plurality of pixels constitute a set of pixels, the side surface inclination angle of a protrusion is varied from one pixel to another in each pixel set, and the side surface inclination angle of the protrusion in each pixel is fixed.

177. (Previously Presented) A liquid crystal display device according to claim 158, wherein said first and second domain regulating means respectively include line portions, and widths of said line portions of said first and second domain regulating means are different.

178. (Previously Presented) A liquid crystal display device according to claim 157, wherein said second structure includes depressions depressed from a layer of said liquid crystal.

179. (Previously Presented) A liquid crystal display device according to claim 157, wherein said second structure includes a pair of protrusions and depressions

on said second substrate for changing a portion of a contact surface between said second substrate and said liquid crystal into inclined surfaces.

180. (Previously Presented) A liquid crystal display device according to claim 179, wherein said protrusions and depressions on each substrate are mutually arranged in parallel with pitches of one and three, said protrusions and depressions of said first and second substrates are arranged in parallel to each other and are arranged so that said protrusions and said depressions face wide spaces corresponding to large pitch, and protrusions and depressions of different substrates respectively neighbor.

181. (Previously Presented) A liquid crystal display device according to claim 156, wherein said protrusions of said first domain regulating means and said second structures are arranged on parametric portions outside of a display area where no pixels exist.

182. (Previously Presented) A liquid crystal display device according to claim 150, wherein said second domain regulating means includes slits provided on a second electrode of said second substrate.

183. (Previously Presented) A liquid crystal display device according to claim 182, wherein a second electrode on said second substrate consists of pixel

electrodes, and each pixel electrode includes partial electrodes divided by said slits and electrical connection portions electrically connecting said partial electrodes.

184. (Previously Presented) A liquid crystal display device according to claim 183, wherein said electrical connection portions are arranged at a perimeter of said pixel electrodes.

185. (Previously Presented) A liquid crystal display device according to claim 183, comprising light shield means for shielding a part of said electrical connection portions.

186. (Previously Presented) A liquid crystal display device according to claim 182, wherein said second domain regulating means includes protrusions that are higher than surfaces of said pixel electrodes and that are arranged inside said slits.

187. (Previously Presented) A liquid crystal display device according to claim 182, where said first and second domain regulating means respectively include line portions, and widths of said line portions of said first and second domain regulating means are different.

188. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means are an array

of protrusions each extending in a generally straight line, said protrusions are arranged in parallel to one another with a predetermined pitch among them, second domain regulating means includes an array of protrusions or depressions or slits each extending in a generally straight line, said protrusions, depressions or slits are arranged in parallel to one another with said predetermined pitch among them, and said predetermined pitch is less than an arrangement pitch of said pixel electrodes.

189. (Previously Presented) A liquid crystal display device according to claim 188, wherein widths of said first and second domain regulating means are different.

190. (Previously Presented) A liquid crystal display device according to claim 188, wherein said second domain regulating means includes protrusions or slits, said protrusions of said first domain regulating means and said protrusions or slits of said second domain regulating means are offset by a half of said predetermined pitch.

191. (Previously Presented) A liquid crystal display device according to claim 188, wherein said second domain regulating means includes protrusions or slits, said protrusions of said first domain regulating means and said protrusions or slits of said second domain regulating means are offset from a state in which said protrusions or slits face, and said offset is smaller than said predetermined pitch.

192. (Previously Presented) A liquid crystal display device according to claim 188, wherein said protrusions of said first and second domain regulating means are arrays of protrusions each extending in a generally straight line, a liquid crystal injection port through which said liquid crystal is injected into a gap between said first and second substrates is located on a side of said device vertical to a direction in which said protrusions are extending.

193. (Previously Presented) A liquid crystal display device according to claim 192, wherein exhaust ports through which air or liquid crystal are exhausted from the gap when said liquid crystal is injected are located on a side opposite to the side on which said liquid crystal injection port is located.

194. (Previously Presented) A liquid crystal display device according to claim 192, wherein an electrode used to apply a voltage to said liquid crystal and having no relation to display is formed near said liquid crystal injection port.

195. (Previously Presented) A liquid crystal display device according to claim 150, further comprising auxiliary domain regulating means arranged on said first substrate.

196. (Previously Presented) A liquid crystal display device according to claim 195, wherein said auxiliary domain regulating means is branched from said first

domain regulating means, and said auxiliary domain regulating means is integrally formed with said first domain regulating means.

197. (Previously Presented) A liquid crystal display device according to claim 196, wherein said first domain regulating means is arranged obliquely to each edge of said pixel, and said auxiliary domain regulating means is arranged at positions where said first domain regulating means crosses edges of said pixel at an angle of more than 90 degrees.

198. (Previously Presented) A liquid crystal display device according to claim 197, wherein said auxiliary domain regulating means is arranged along a part and in the neighborhood of an edge of said pixel.

199. (Previously Presented) A liquid crystal display device according to claim 150, comprising auxiliary electrodes for forming a storage capacitor with pixel electrodes, wherein said auxiliary electrodes are formed alongside said domain regulating means.

200. (Previously Presented) A liquid crystal display device according to claim 150, comprising light shielding patterns provided alongside said domain regulating means.

201. (Previously Presented) A liquid crystal display device according to claim 150, wherein a color filter substrate, which is one of said two substrates, comprises:

a transparent support member;

plural kinds of color decomposition filters formed on said transparent support member for each of the regions;

a transparent electrode formed on said color decomposition filters; and

a light-shielding film formed at any position on said transparent electrode.

202. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means are formed of a photosensitive resist.

203. (Previously Presented) A liquid crystal display device according to claim 202, wherein said photosensitive resist is a novolak resist.

204. (Previously Presented) A liquid crystal display device according to claim 202, wherein said photosensitive resist is baked after a pattern is drawn.

205. (Previously Presented) A liquid crystal display device according to claim 150, wherein the capacitance of said protrusions of said first domain regulating

means is ten or less times larger than the capacitance of a layer of said liquid crystal located under or near said protrusions.

206. (Previously Presented) A liquid crystal display device according to claim 150, wherein the specific resistance of said protrusions of said first domain regulating means is equal to or larger than the specific resistance of said liquid crystal.

207. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means are made of a material that shields visible light

208. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means are provided with dents that each have a slope in a longitudinal direction.

209. (Previously Presented) A liquid crystal display device according to claim 150, wherein juts that each partly have a slope in a longitudinal direction are formed on said protrusions of said first domain regulating means.

210. (Previously Presented) A liquid crystal display device according to claim 150, wherein center portions of said protrusions of said first domain regulating means are depressed.

211. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means include a plurality of small holes extending near the surface of said electrodes.

212. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means include ion absorption ability.

213. (Previously Presented) A liquid crystal display device according to claim 212, wherein said protrusions of said first domain regulating means are made of materials including an addition agent having ion absorption abilities.

214. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means include protrusions projected to a layer of said liquid crystal, and the surfaces of said protrusions are treated so as to be adapted for forming vertical alignment films thereon.

215. (Previously Presented) A liquid crystal display device according to claim 214, wherein said surface treatment to the surfaces of said protrusions is effected for forming ruggedness.

216. (Previously Presented) A liquid crystal display device according to claim 214, wherein said protrusions are made of a resist, and said surface treatment of the surfaces of said protrusions is effected for irradiating with ultraviolet rays upon the surfaces of said protrusions.

217. (Previously Presented) A liquid crystal display device according to claim 214, wherein said protrusions are made of materials in which particulate is dispersed.

218. (Previously Presented) A liquid crystal display device according to claim 214, wherein a silane coupling agent is coated upon the surfaces of said protrusions.

219. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means are formed by printing.

220. (Previously Presented) A liquid crystal display device according to claim 150, wherein said protrusions of said first domain regulating means include at least one layer simultaneously formed with other portions of the device.

221. (Previously Presented) A liquid crystal display device according to claim 220, wherein one of said protrusions of said first domain regulating means, which is on a TFT substrate on which active elements are formed, includes at least one insulating layer for insulating said active elements or bus lines.

222. (Previously Presented) A liquid crystal display device according to claim 220, wherein said protrusions of said first domain regulating means are formed on a color filter (CF) substrate facing a TFT substrate on which active elements are formed, and said protrusions on said CF substrate are made of materials that are the same as the materials of black matrices for shielding light at boundaries between pixel electrodes and bus lines of portions of said active elements.

223. (Previously Presented) A liquid crystal display device according to claim 222, wherein said protrusions on said CF substrate are formed by piling at least color filter material.

224. (Previously Presented) A liquid crystal display device according to claim 222, wherein said protrusions on said CF substrate are formed by photo lithography with a mask corresponding to piled portions of at least two color filters.

225. (Previously Presented) A liquid crystal display device according to claim 220, wherein said second domain regulating means includes protrusions formed on

a color filter (CF) substrate facing a TFT substrate on which active elements are formed, and said protrusions on said CF substrate are made of materials that are the same as the materials of black matrices for shielding light at boundaries between pixel electrodes and bus lines or portions of said active elements.

226. (Previously Presented) A liquid crystal display device according to claim 225, wherein said protrusions on said CF substrate are formed by piling at least one color filter material.

227. (Previously Presented) A liquid crystal display device according to claim 225, wherein said protrusions on said CF substrate are formed by photo lithography with a mask corresponding to piled portions of at least two color filters.

228. (Previously Presented) A liquid crystal display device according to claim 220, wherein said protrusions of said first domain regulating means are formed on a color filter (CF) substrate facing a TFT substrate on which active elements are formed, an electrode of said CF substrate is directly formed on color filters, and said protrusions on said CF substrate are formed at boundaries of said color filters.

229. (Previously Presented) A liquid crystal display device according to claim 220, wherein said second domain regulating means includes protrusions formed on a color filter (CF) substrate facing a TFT substrate on which active elements are formed,

an electrode of said CF substrate is directly formed on color filters, and said protrusions on said CF substrate are formed at boundaries of said color filters.

230. (Previously Presented) A liquid crystal display device according to claim 150, wherein a portion of said first and second domain regulating means is arranged at a perimeter of each pixel.

231. (Previously Presented) A liquid crystal display device according to claim 230, wherein said portions arranged at a perimeter of each pixel are protrusions made of a light shielding material.

232. (Previously Presented) A liquid crystal display device according to claim 231, wherein said protrusions arranged at a perimeter of each pixel define a thickness of a layer of said liquid crystal.

233. (Previously Presented) A liquid crystal display device according to claim 231, wherein the perimeter at which said protrusions are arranged is a part of the whole perimeter of each pixel.

234. (Previously Presented) A liquid crystal display device according to claim 230, wherein said protrusions arranged at a perimeter of each pixel define a thickness of a layer of said liquid crystal.

235. (Previously Presented) A liquid crystal display device according to claim 234, wherein the perimeter at which said protrusions are arranged is a part of the whole perimeter of each pixel.

236. (Previously Presented) A liquid crystal display device according to claim 230, wherein the perimeter at which said protrusions are arranged is a part of a the whole perimeter of each pixel.

237. (Previously Presented) A liquid crystal display device according to claim 158, wherein the height of said protrusions of one of said first and second domain regulating means is equal to a desirable thickness of a layer of said liquid crystal, and said protrusions of the one of said first and second domain regulating means define a thickness of a layer of said liquid crystal.

238. (Previously Presented) A liquid crystal display device according to claim 158, wherein electrodes of said first and second substrates are partially formed on one of the slopes of said protrusions.

239. (Previously Presented) A liquid crystal display according to claim 238, wherein said protrusions of said first and second domain regulating means pass visual light.

240. (Previously Presented) A liquid crystal display device according to claim 158, wherein said protrusions of said first and second domain regulating means are arranged so that slopes of said protrusions upon which no electrodes are formed are nearer to each other.